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A Case Series of Attention Modification in Clinically-Anxious Youths

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Abstract

Research in the last fifteen years suggests that anxious individuals selectively attend towards threatening information. Attention modification interventions for internalizing adults have been developed to target cognition at this basic level; these programs have demonstrated initial efficacy in attention bias and anxiety symptom reduction. To date, there have been no published studies of attention modification in youths with clinical levels of anxiety. The current case series examined the initial efficacy of a four week (12 session) attention modification program (AMP) designed to train attention away from threat in 16 children and adolescents (ages 10 to 17) diagnosed with DSM-IV anxiety disorders. Overall, youths experienced a significant decrease in anxiety and depression symptoms, and 12 of 16 youths no longer met criteria for any anxiety diagnosis at post-treatment. AMP was feasible with youths, and all youths and parents deemed the program acceptable. These findings provide support for further research on the use of cognitive bias modification interventions with clinically anxious youths.

Keywords

attention bias; anxiety; youths; attention modification; cognitive bias

Anxiety disorders are the most prevalent mental health problem in children and adolescents (25%; Kashani & Orvaschel, 1990). Anxiety is distressing and disabling in the present (Strauss, Frame, & Forehand, 1987) and predicts long-term negative physical and mental health outcomes when left untreated (e.g., Bittner, Egger, Erkanli, Costello, Foley, & Angold, 2007; Woodward & Fergusson, 2001). Major theories of anxiety implicate the role of biased cognitive processing of negative stimuli (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). Specifically, clinically anxious adults and youths demonstrate an early and automatic attention towards threatening stimuli as compared to

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non-anxious controls, across a variety of paradigms (e.g., Mathews & MacLeod, 2005; Mogg & Bradley, 1995; Roy et al., 2008).

Recently, cognitive bias modification (CBM) interventions have been developed that directly target attention in anxious adults. CBM treatments modify the typical performance-based tasks used to assess attention such that the probes participants respond to during the task are manipulated to appear more frequently with neutral, rather than negative, stimuli. As a result, participants are shaped to disengage attention away from negative stimuli and towards neutral stimuli. Findings suggest that anxious individuals receiving attention modification demonstrate significantly greater reduction of attention bias towards threat and experience significantly greater internalizing symptom remission than anxious individuals receiving computerized control conditions which do not train attention away from threat (e.g., Amir, Beard, Burns, & Bomyea, 2009). Such work has been conducted in adults with generalized anxiety disorder (Amir et al., 2009), social anxiety disorder (Amir, Beard, Taylor, Klumpp, Elias, Burns, & Chen, 2009; Amir, Weber, Beard, Bomyea, & Taylor, 2008; Schmidt, Richey, Buckner, & Timpano, 2009), and obsessive-compulsive disorder (Najmi & Amir, 2010). There has been a call for continued work in this area in order to develop attention modification as an efficacious intervention for the treatment of internalizing problems more broadly (MacLeod, Koster, & Fox, 2009).

Despite this previous work on attention modification with adults, the youth anxiety literature is at a much earlier stage of development. To date, there has only been one published trial of attention training in a youth sample (Eldar, Ricon, & Bar-Haim, 2008). Eldar and colleagues randomly assigned children (ages 7 to 12) reporting trait anxiety scores within 1 standard deviation of the normal range to either attention training towards threat or attention training away from threat across two sessions. Youths trained towards threat developed attentional vigilance to threat-related information and elevated anxiety following a stress-induction task; however, training away from threat was ineffective in changing attentional bias or self-reported mood. Attention training away from threat may have been unsuccessful for a variety of reasons, including the nature of the sample (i.e., non-anxious youths), but this investigation does raise questions about whether attention modification will demonstrate the same effects for youths as it has with adults.

There is good reason to explore whether basic cognitive processes may be useful mechanisms to target in treating anxiety in children and adolescents. Attention modification with adults has been very successful in anxiety reduction (e.g., 50% of participants receiving attention training away from threat no longer meet for anxiety diagnosis at post-treatment, as compared to 14% receiving attention control condition; Amir, Beard, Taylor et al., 2009). Additionally, given developmental limitations, some children and adolescents may have difficulty with mastering the abstract reasoning skills taught in cognitive behavioral therapy (CBT) (Kingery, Roblek, Suveg, Grover, Sherrill, & Bergman, 2006; Weisz & Weersing, 1999), the best-supported psychosocial intervention for anxious youths (e.g., In-Albon & Schneider, 2006). Moreover, severe attention bias towards threat at the start of treatment may predict poor treatment response for anxious youths receiving CBT (Legerstee et al., 2008). Finally, a large proportion of youths receiving evidence-based intervention (i.e., CBT, pharmacotherapy with SSRIs) still present within the clinically-impaired range at

post-treatment (40%; Compton, March, Brent, Albano, Weersing, & Curry, 2004), and this rate may increase over follow-up as youths experience relapse. Together, these findings suggest value in exploring cognitive bias modification as a novel potentially efficacious intervention for youth anxiety.

Prior to conducting large-scale, randomized investigations of attention modification, pilot work should demonstrate that cognitive bias modification is safe and feasible with clinically-anxious youths. In the present case series, we examined the utility of a four week (12 session) attention modification program in clinically anxious youths. Following a baseline assessment to determine inclusion, all youths completed twelve sessions of attention training away from threatening stimuli over the course of four weeks, followed by a post-treatment assessment to examine potential changes in anxiety symptoms and diagnoses. Youths did not receive any other interventions or services for mental health problems while completing the attention modification program.

METHOD

Participants

Participants were 16 clinically-anxious youths ages 10 to 17 ($M = 14.00$, $SD = 2.66$) presenting for services at a youth internalizing disorders treatment research center. Youths were included in the case series if they (a) met for a primary diagnosis of either Separation Anxiety Disorder, Social Phobia, or Generalized Anxiety Disorder, (b) were aged 8 to 17, (c) lived with a legal, consenting guardian for the past six months, (d) spoke proficient English, (e) showed no evidence of suicidal ideation with plan or intent, (f) were not currently receiving psychotherapeutic or pharmacologic intervention for anxiety or depression, (g) had no change in other psychosocial treatments or medication during six weeks prior to study entry, (h) did not require alternate intervention for a more immediate concern (e.g., uncontrolled ADHD, bipolar disorder), and (i) were performing at grade-level academically with no additional school services or learning deficits. Four youths were excluded during the baseline interview for failing to meet diagnostic inclusion criteria for a primary anxiety disorder. None were excluded for other reasons. Prior to baseline procedures, parents provided written consent and youths provided written assent to study participation approved by university institutional review board. During consent procedures, youths and parents were provided with a brief description of the attention modification program but were not provided specific information regarding the training paradigm or procedure (e.g., “Kids and teens who often feel worried, nervous, or scared tend to focus on negative things in their environment. The purpose of this study is to see if a new computer program will help kids feel less worried, nervous, or scared by teaching them to focus on their environment differently.”) At the post-treatment assessment, clinical interviewers again queried youths and parents to ensure youths had not obtained any additional form of intervention during their participation in this study.

Materials and Tasks

Clinician-rated measures, youth self- and parent-reports of anxiety, and performance-based attention assessment (dot probe task) were administered at baseline and post-treatment.

Clinical assessors were two Master's-level graduate students trained and supervised by a Ph.D.-level psychologist. A random 20% of interviews by each assessor were re-rated by the other assessor for reliability, with 100% agreement for all diagnoses and high interrater reliability for clinician-rated dimensional measures ($r = 0.83$ for anxiety; $r = 0.86$ for depression). Study assessors were not blind to the study's purpose or assessment time point. A third coder, who was blind to the study's purpose (including intervention type and interview time point) re-rated all of the reliability tapes from the two assessors, again resulting in 100% diagnostic agreement and high interrater reliability for clinician-rated dimensional measures ($r = 0.88$ for anxiety, $r = 0.93$ for depression).

Youth Diagnostic and Symptom Measures

Schedule for Affective Disorders and Schizophrenia for School-Age Children

— **Present Version**—(K-SADS-P; Kaufman, Birmaher, Brent, Rao, & Ryan, 1996) is a semi-structured interview, administered by a clinician, to assess for diagnosis of anxiety and other DSM-IV Axis I disorders. This is a widely-used diagnostic interview with well-established psychometric properties. The K-SADS was used to assess for study inclusion (i.e., primary anxiety disorder) and compare youths meeting diagnostic criteria from pre- to post-treatment.

Pediatric Anxiety Rating Scale—(PARS; RUPP, 2002) is a clinician-rated dimensional measure that integrates youth and parent report to assess the presence and severity of anxiety, as well as related functional impairment. The PARS is comprised of a 50-item symptom checklist and seven global severity/impairment items summed for a continuous total score of 0–35. The PARS has high inter-rater reliability, adequate internal consistency, and fair test-retest reliability. There is preliminary support for convergent and divergent validity, and sensitivity to treatment effects in clinical trials (e.g., RUPP, 2002; Walkup et al., 2008).

Children's Depression Rating Scale – Revised—(CDRS-R; Poznanski & Mokros, 1996) is a clinician-rated dimensional measure that integrates youth and parent report to assess the presence and severity of depression in youths. The CDRS-R is composed of 17 items tapping the major features of depression; scores of 40 and above are considered reflective of a depression diagnosis. The CDRS-R has good inter-rater reliability, internal consistency, convergent validity with other measures of depression in youth, and is sensitive to treatment effects (e.g., Kennard et al., 2006).

Screen for Child Anxiety Related Emotional Disorders—(SCARED; Birmaher, Brent, Chiappetta, Bridge, Monga, & Baugher, 1999) is a 41-item measure of anxiety symptoms with youth- and parent-reported versions, with scores of 25 and above (total score ranges from 0 to 82 points) considered reflective of significant symptoms of anxiety. The scale has been validated in diverse clinical and community samples, with good internal consistency, and has been utilized as a secondary outcome measure of anxiety symptom change in several randomized clinical trials of treatment for youth anxiety (e.g., Walkup et al., 2008).

Mood and Feelings Questionnaire—(MFQ; Wood, Kroll, Moore, & Harrington, 1995) is a 33- and 34-item assessment of depression symptoms with youth- and parent-reported versions, with scores above 25 points considered reflective of significant depressive symptoms (total score ranges from 0 to 66 for the child version and from 0 to 68 for the parent version). The scale has been validated with sound psychometric properties and sensitivity to symptomatic change over time. We used the MFQ to examine whether potential changes in depression symptomatology occur alongside anxiety symptom change from pre- to post-treatment.

Participant Acceptability Questionnaire is a youth- and parent-reported assessment of procedure and intervention acceptability and credibility and was adapted by the authors for this study from similar scales used by the Research Units on Pediatric Psychopharmacology. The PAQ includes questions on burden (e.g., travel, boredom), beliefs about computerized intervention techniques (i.e., credibility), and youth comprehension of the task. The PAQ is scored on a scale of 0 (“very poor/unacceptable”) to 5 (“excellent”) and was administered at the post-treatment assessment.

Attention Assessment—The attention dot probe task was developed by MacLeod and colleagues (MacLeod, Mathews, & Tata, 1986) and has been modified for use in child anxiety studies as a measure of performance-based attention (see Bar-Haim et al., 2007 for a review). The faces used in the task were selected from a standardized set of emotional expressions (Matsumoto & Ekman, 1989) that have been used in many attention assessment investigations (e.g., Amir, Beard, Taylor, et al., 2009). The set includes eight individuals (four men, four women) displaying threatening (i.e., disgust, anger) and neutral expressions. We used faces, rather than words, in this investigation due to developmental considerations in work with youths (i.e., variations in reading ability depending on age and other achievement-related factors). During the attention assessment task, youths were presented with 256 trials of paired faces. Each trial began with a fixation cross (“+”) presented in the center of the monitor for 500 milliseconds (ms), immediately followed by two faces of the same individual on the top and bottom portions of the screen, with each pair displaying one of two combinations of emotions (i.e., neutral and disgust, disgust and neutral, or neutral and neutral). Faces were positioned 3.0 cm from the top of the screen and separated by 1.5 cm between the bottom of the top image and top of the bottom image. Both faces were centered horizontally. After presentation of the faces for 500 ms, a probe (either the letter *E* or *F*) appeared in the location of one of the two faces. Youths were instructed to determine whether the letter was an *E* or an *F* and press a corresponding button (left or right mouse click) using their dominant hand. The probe remained on the screen until the youth responded to that trial, after which the next trial began. During this task, the probe appeared in the same location as the threat faces on 50% of trials and in the location of the neutral face on 50% of trials, for 256 total trials. The program monitored youth accuracy in identifying the probe location, as well as reaction time in response to each trial. Prior to beginning the task, youths were instructed to perform the task as quickly and accurately as possible. One trial of the task is depicted in Figure 1.

On average, the attention assessment task took youths 15 to 20 minutes to complete. A research assistant sat in the room with youths in order to ensure that youths completed the

task as instructed. Youths were instructed to not speak with the research assistant during the duration of the task. Research assistants were trained to respond to youths with, “Please keep working on the computer game; we can talk when you’re done,” if a youth spoke to the research assistant (e.g., asked a question) or stopped performance during the task. The task was administered at baseline and post-treatment assessment. Youths demonstrated 92% accuracy on the task at baseline assessment and 96% accuracy at post-treatment assessment; accuracy rates indicate appropriate usage of computer mouse and keyboard during task, including responses that were considered too fast (<200 milliseconds, suggesting youth clicked prior to processing stimuli) and responses that were considered too slow (>3500 milliseconds, suggesting cognitive processes too controlled to reflect attention). These same data cleaning procedures for accuracy were used to examine the AMP data (see below), as well as clean data for analyses.

AMP—All youths received a computer-delivered attention modification program designed to enhance attention disengagement from threatening information. The AMP protocol includes twelve 10 to 15 minute sessions delivered over a four-week period (i.e., three sessions per week). This program is a variation of the dot probe paradigm used as the attention assessment (described previously) and participants were given the same instructions for the AMP as they were for the attention assessment task. During each session, youths saw 160 trials that consisted of the various combinations of probe type (*E* or *F*), probe position (top or bottom), and emotion type (same eight individuals displaying disgust and neutral faces as in the attention assessment task). In 80% of trials, the probe followed the neutral face. Thus, although there were no specific instructions to direct attention away from threatening faces, on 80% of trials the position of the disgust face revealed the position of the probe (i.e., in the location opposite the disgust face). The remaining 20% of trials included only neutral faces.

Procedure

All consent procedures, clinical interviews, and weekly clinical check-ins were conducted by Master’s-level graduate students and supervised by Ph.D.-level psychologists. At baseline, youths and parents completed a diagnostic interview and self-reports, and youths completed a performance-based assessment of attention (faces dot probe). Youths returned one week later, during which time they were taught how to self-administer the AMP program, were provided with a USB drive for trainings completed at home, and completed training session 1 in the laboratory. Youths completed one in-lab training each week for four weeks (sessions 1, 4, 7, and 10), as well as two training sessions at home each week between each in-lab training (sessions 2 and 3 during week 1, sessions 5 and 6 during week 2, etc.). Youths were offered phone call or email reminders for at-home trainings, and they were provided with the same instructions to complete the task through the AMP program on their USB drive as they were provided during the first in-lab training. At weekly in-lab training sessions, a trained Master’s-level graduate student conducted a quick (less than five-minute) clinical check-in to ensure youth safety (i.e., “Are you having any thoughts of hurting yourself or someone else?”). Four youths missed one in-lab training session and one youth missed two in-lab training sessions for practical reasons (e.g., sick, transportation); these youths were instructed to make up their missed in-lab training at home, as their parents were

unable to come to our offices until their next scheduled in-lab training. Youths were not provided with any additional clinical contact or services throughout the duration of their participation.

After completing all twelve trainings over the course of four weeks, youths and parents completed a post-treatment assessment identical to the baseline assessment battery. The post-treatment assessment occurred between four and twelve days after the final (12th) AMP training, with an average post-treatment date eight days after the final AMP training. At post-treatment assessment, clinicians queried about receipt of other services outside of the AMP program; all 16 youths and their parents confirmed that no other services were obtained during study participation.

AMP Treatment Adherence—The graduate student completing the clinical check-in during in-lab trainings also examined youths' USB drives to ensure that they had successfully completed two trainings at home as instructed. On five occasions with three different participants, youths had only completed one training at home in between lab training sessions; in all instances youths were instructed and successfully completed an extra training at home that week in order make up for the missed training. As a result, all youths completed all scheduled trainings. AMP data were also examined each week for accuracy in order to insure that youths were appropriately completing the task. Youths demonstrated very good accuracy rates on the task for at-home trainings (91%), which was comparable to accuracy rates during in-lab trainings (94%).

RESULTS

Table 1 provides youth clinical characteristics at baseline. All youths were diagnosed with a primary anxiety disorder, with 56% of youths also meeting DSM-IV criteria for a secondary anxiety disorder. Although our inclusion criteria allowed for primary diagnosis of Separation, Social, and Generalized Anxiety Disorders, note that nearly the entire sample met for a primary diagnosis of either Social or Generalized Anxiety, with only one youth meeting for a primary diagnosis of Separation Anxiety Disorder. Analyses were conducted with and without the single youth meeting for primary Separation Anxiety, with no difference in results. At baseline, three youths met for secondary diagnoses of dysthymia and just over half of youths experienced clinically elevated depressive symptoms as assessed by standardized youth-, parent-, or clinician-rated dimensional measures.

We first conducted paired sample t-tests to examine changes in youth anxiety symptoms from baseline to post-treatment for youth (SCARED-C), parent (SCARED-P), and clinician-rated (PARS) measures. Then, we calculated the Reliable Change Index¹ (RCI; Jacobson &

¹Reliable change index (RCI) was calculated according to methods outlined by Jacobson and Truax (1991) using the following

formula: $RCI = \frac{x_1 - x_2}{S_{diff}}$ where $S_{diff} = \sqrt{2(S_E)^2}$, $S_E = s_1 \sqrt{1 - r_{xx}}$, x_1 = pretreatment score, x_2 = post-treatment score, s_1 = standard deviation of the normal population, r_{xx} = test-retest reliability of the measure. An RCI > 1.96 represents reliable change (at $\alpha = .05$). A change is said to be clinically significant if (a) there is a reliable change and (b) the pre- to post-treatment score on the measure crosses the clinical cutoff. Normative data used to measure RCI and clinical change in these cases were as follows: MFQ: $s_1 = 12.40$, $r_{xx} = .78$ (Wood et al., 1995); SCARED: $s_1 = 12.14$ (Wren, Bridge, & Birmaher, 2004), $r_{xx} = .86$ (Birmaher et al., 1997). MFQ-P RCI was not calculated for youth #7, as her mother only completed the SMFQ. See Footnote 2.

Truax, 1991) to examine whether symptom reduction for each youth represented a substantial clinical change. As shown in Table 2, paired sample t-tests indicated that, on average, measures of anxiety were significantly lower at post-treatment than pre-treatment, across all reporters. Anxiety diagnoses also followed this pattern: While all youths met for at least one anxiety disorder at pre-treatment, only four youths (#5, #10, #14, and #15; Table 1) still met for any anxiety disorder at post-treatment. Upon closer examination of the data, these four youths were among the most severe in the sample, with multiple comorbid anxiety diagnoses, high youth-reported anxiety symptoms (SCARED-C total score at baseline of 51, 39, 53, and 55 points, respectively [$M = 49.50$], as compared to a baseline SCARED-C range of 12 to 40 points [$M = 26.75$]) for all other youths in the sample), and high youth-reported depressive symptoms (MFQ-C $M=40$, $M=30$, $M=36$, and $M=38$, respectively [$M = 36.00$], as compared to baseline MFQ-C range of 2 to 30 points [$M = 14.83$] for all other youths in the sample). Across the sample, RCI calculations with the SCARED-C demonstrated that 13 of 16 youths reliably experienced clinically significant reductions in anxiety symptoms by the post-treatment assessment, while the SCARED-P indicated that 10 of 16 youths experienced clinically significant reductions in anxiety symptoms. Examining symptoms as assessed at each in-lab training indicated that, on average, symptom remission did not meet criteria for reliable change until session 10 (after 9 trainings had been completed).

We also conducted paired samples t-tests to examine potential changes in depressive symptoms on youth (MFQ-C), parent² (MFQ-P), and clinician-rated (CDRS-R) measures. As with anxiety, all dimensional measures of youth depression were significantly lower at post-treatment than at pre-treatment (Table 2). For youths with clinically elevated depression symptoms at baseline, we computed RCI scores. By the time of post-treatment assessment, eight of nine youths reliably moved from the clinical to the non-clinical range on the MFQ-C, and five of six youths reliably moved from the clinical to the non-clinical range on the MFQ-P. For youths with elevated depressive symptoms at baseline, examination of self-reported depression as measured at each in-lab training indicated that, like anxiety, depressive symptoms improved over the course of the AMP intervention; again, on average this symptom remission did not meet criteria for reliable clinical change until session 10.

We then examined reaction time data from the dot probe assessment task as an initial test of whether attention bias change might be related to change in symptoms. Mean attention bias scores were derived from the standard formula developed by Mathews and MacLeod (2005) used across adult, and several youth, studies. For each youth, bias was calculated by subtracting mean reaction times when the specified negative facial type and probe appeared on the same side of the display from the mean reaction times on trials where that face type and probe appeared on opposite sides of the display. There was a mean change of 107.78 milliseconds (just over 1 second) in attention bias from pre- to post-treatment. Moreover,

²The mother of youth #7 was a monolingual Spanish-speaker. This parent completed a Spanish version of the K-SADS-P with a bilingual clinician, as well as Spanish-versions of the SCARED-P and Short Mood and Feelings Questionnaire (SMFQ-P; Angold, Costello, Messer, & Pickles, 1995), as the MFQ is not currently validated in Spanish. The SMFQ-P is a 13-item screening measure adapted from the MFQ-P. This parent's SMFQ-P score was converted into an MFQ-P score for data analyses. Analyses were conducted with and without this parent-reported data included, with no changes in results.

this change in attention bias was significantly correlated with a change in clinician-rated anxiety symptoms as measured by the PARS ($r = .59, p = .031$). However, because of the small sample size and substantial variability in the bias scores, this change in attention bias failed to reach significance ($t(15) = 1.681; p = .115$) from pre-to-post assessment.

Finally, we examined youth- and parent-reported scores of intervention acceptability and credibility (PAQ; see measures). Ratings of the intervention ranged from “acceptable” to “excellent” for both parents and youths, with mean ratings of 4.5 out of 5 points ($SD = .71$) for parents and 4.2 out of 5 points ($SD = .60$) for youths.

DISCUSSION

This case series examined the value of developing attention modification as a treatment for youth anxiety. Despite the short treatment duration (twelve 15-minute training sessions over the course of four weeks), youths in this clinical case series demonstrated significant symptomatic improvement from pre- to post-treatment, and 12 of 16 youths (75%) no longer met criteria for any anxiety disorder diagnosis at post-treatment. In addition, the four youths who still met DSM-IV criteria for an anxiety disorder at post-treatment presented at baseline with more severe internalizing symptoms than other youths in the sample. These severe youths still demonstrated reliable change in anxiety symptoms, moving from the clinical to non-clinical range on youth and parent reports. Furthermore, across all youths, depression scores as measured by clinician-, youth-, and parent-report also significantly improved over time.

Of note, the youths in this case series are similar in severity to those enrolled in typical efficacy trials of youth anxiety. All of our youth participants met full diagnostic criteria for at least one DSM-IV anxiety diagnosis and displayed elevated levels of self- and parent-reported anxiety at baseline. In examining our sample next to the CAMS trial (Walkup et al., 2008), the latest and largest youth anxiety RCT to date, the mean PARS score for CAMS youths at baseline was 19.13 ($SD=3.90$); the mean PARS score for youths in the present case series was 22.60 ($SD=2.95$). In contrast, the only other published trial of attention modification in youths (Eldar et al., 2008) selected non-diagnosed participants reporting levels of anxiety within one standard deviation of the community mean of a youth self-report measure. Eldar and colleagues were not able to demonstrate that training youths away from threat impacted anxiety symptoms in this subclinical sample. This case series, thus, provides the first data on the potential efficacy of cognitive bias training procedures in youths with clinically impairing levels of anxiety.

The findings also suggest that AMP may be efficacious in reducing co-occurring depressive symptomatology in anxious youths, even though depression was not a direct target of the intervention. Reports of significant depression reduction were consistent across youth-, parent-, and clinician-rated measures. These results are encouraging, given the high level concurrent (8%–40%) and lifetime (21%–71%) comorbidity between anxiety and depression (e.g., Angold, Costello, & Erkanli, 1999), and very poor long-term outcomes experienced by comorbid youths (e.g., Copeland, Shanahan, Costello, & Angold, 2009; Lewinsohn, Rohde, & Seeley, 1995). Given the high rates and negative impact of internalizing comorbidity,

researchers have begun to move towards a transdiagnostic conceptualization of anxiety and depression and efforts have begun to develop unified treatment approaches (e.g., Barlow, Allen, & Choate, 2004; Weersing, Gonzalez, Campo, & Lucas, 2008). These results suggest value in investigating CBM interventions from a transdiagnostic perspective. Short, computerized interventions would have high public health impact if they were able to treat co-occurring internalizing problems in youths in an efficient and inexpensive way.

We also conducted an initial test on the proposed mechanism of action: attention bias change. Although the change in reaction time was related to change in symptoms, the pre-to-post-treatment reduction in attention bias did not reach statistical significance. This may have occurred for a number of reasons, including, but not limited to, variability in youth attention bias at baseline or operation of secondary cognitive processes (e.g., attention bias still remains; however, youths are better able to control responding). The attention bias finding is not unique to our trial, and current theorists propose that a disruption in attention, or ability to disengage from threat, may be more important than attentional change in any given direction (e.g., Amir, Elias, Klumpp, & Pzeworski, 2003; Koster, Crombez, Verschuere, & Houwer, 2004). The adult attention literature has discussed such potential explanations for variability in reaction time data (e.g., Mogg & Bradley, 2005), with calls for the development of more accurate measurement of performance-based assessment (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). However, in our sample the average attention change was in the expected direction (i.e., decrease in attention towards threat), and change in attention was significantly correlated with change in clinician-rated anxiety symptoms.

As a function of the case series design, this investigation has limited ability to attribute clinical change to AMP procedures. However, data from CBT randomized trials suggest that youth anxiety diagnoses are highly stable in the short-term, with little to no change in diagnostic status reported in waitlist control groups (e.g., 5% youths randomized to waitlist remitted in Kendall, 1994; 6% remitted in Kendall et al., 1997) or pill placebo comparison conditions (23% youths remitted in Walkup et al., 2008) over the duration of investigations. Given that 80% of youths in the current investigation experienced sudden, reliable symptom and diagnostic change, it seems unlikely that spontaneous remission or regression to the mean is a plausible explanation of effects. Also note that youths receiving AMP did not participate in any additional services during the study, and clinical contact with study staff was minimized to five-minute safety check-ins at each of the four training sessions – suggesting that the procedures of AMP are more likely agents of change than non-specific therapeutic factors.

Some methodological limitations should also be noted. First, clinicians conducting pre- and post-assessments with youths were not blind to study purpose or assessment time point. However, diagnostic change from pre-to-post treatment mirrors youth- and parent-reported anxiety and depression symptom change. Furthermore, reliability ratings across both assessors, even as conducted by a third assessor who was blind to study purpose, intervention type, and assessment time point, resulted in 100% diagnostic agreement and very high interrater agreement on clinician-rated dimensional measures of anxiety and depression. Secondly, we were not able to collect data on maintenance of treatment gains in

this protocol. Studies of attention modification with adults using very similar methodology and intervention to that described in this investigation suggest treatment gains are maintained at a four-month follow-up (Amir, Beard, Taylor et al., 2009). Given that our cases series in clinically-anxious youths demonstrates similar findings to adult AMP trials at post-treatment, there is reason to expect that treatment gains may also be maintained over follow-up for youths. Altogether, despite the limitations inherent in a case series design, we find the results of this study plausible and supportive of additional larger-scale treatment research on attentional retraining in clinically anxious youths.

We are also encouraged that the intervention provided within this case series was delivered with fidelity, completed accurately, viewed as acceptable to families, and required minimal time, resources, and effort by youths, parents, and clinicians (twelve 15-minute computerized training sessions over the course of four weeks). Given these features, interventions such as AMP may have the potential for significant public health benefit should the results of this study be replicated in larger-scale randomized trials. As discussed previously, many youths do not respond to CBT (40%; Compton et al., 2004), in part due to limitations in cognitive development (e.g., Kingery et al., 1999) or severe attentional bias at baseline (e.g., Legerstee et al., 2008). Furthermore, the lack of providers trained in or utilizing CBT suggests that most youths presenting for mental health services do not receive empirically-supported psychosocial interventions (Kazdin, Siegel, & Bass, 1990). Many patients, parents, and providers do not find medications acceptable in the treatment of internalizing problems (Rushton, Clark, & Freed, 2000; Wisdom, Clark, & Green, 2006) or wish to intervene with non-pharmacologic options prior to considering medication (e.g., Asarnow et al., 2005). Brief, easily-disseminated cognitive bias modification interventions may reduce barriers to accessing evidence-based mental health care, provide additional acceptable treatment options to youths and parents, and increase efficacy rates for youths who do not respond to current treatments.

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Figure 1.
Example of single trial in attention assessment and modification tasks

Table 1

Youth clinical characteristics at baseline

Youth	Age	Gender	Anxiety Disorder			Elevated depression*
			Separation	Social	Generalized	
1	16	M	X*		X	
2	14	M		X	X	X
3	11	M		X	X	
4	15	F			X	X
5	17	F		X	X	X
6	11	M			X	
7	17	F			X	X
8	15	M			X	X***
9	15	F		X	X	X
10	10	F	X	X	X	
11	17	F		X	X	X***
12	10	F		X		
13	10	F		X	X	
14	16	F		X		X***
15	15	F		X	X	X
16	15	F		X		

* Indicates probable anxiety disorder, where youth meets DSM-IV criteria for disorder minus one non-core symptom.

** Elevated depression scores indicated from youth- or parent-reported MFQ or clinician-rated CDRS-R.

*** Youth met for secondary dysthymia diagnosis.

Table 2

Internalizing symptom change from pre- to post-treatment

Measure	Baseline Mean (SD)	Post-Treatment Mean (SD)	t	p
PARS	22.60 (2.95)	12.06 (6.35)	14.13	<.001
SCARED-C	32.44 (13.55)	14.59 (16.66)	11.15	<.001
SCARED-P	31.31 (13.94)	16.25 (7.03)	9.34	<.001
CDRS-R	32.33 (7.13)	22.00 (3.61)	13.83	<.001
MFQ-C	20.13 (13.03)	6.44 (6.41)	5.91	<.001
MFQ-P	19.44 (11.97)	6.50 (5.34)	4.84	<.001

Note: CDRS-R = Children's Depression Rating Scale – Revised; MFQ-C = Mood and Feelings Questionnaire – Child Version; MFQ-P; Mood and Feelings Questionnaire – Parent Version; PARS = Pediatric Anxiety Rating Scale; SCARED-C = Screen for Childhood Anxiety Related Disorders – Parent Version; SCARED-P = Screen for Childhood Anxiety Related Disorders – Child Version